

CLAIMS

1. Process for detection of gas bubbles in a liquid adapted to a device comprising a light source (1), a light detector (2) and a data controlling and processing unit (6) linked to a client system (8) comprising the steps of emitting light from the light source (1), for acquisition of the successive measurements of light intensity perceived by the light detector (2) and for calculation of a variation between two successive measurements of said light intensity.
2. Process according to claim 1, characterised in that it further comprises a comparison step of the time variation at a predefined threshold value S.
3. Process according to claim 2, characterised in that it further comprises an incrementation step of an alarm counter (13) by a predefined value A when the variation in light intensity perceived by the light detector (2) between two successive measurements is greater than the threshold S and decrementation of said warning counter (13) by a predefined value B in the opposite case.
4. Process according to claim 3, characterised in that it further comprises a step of sending to the client system (8) information indicating that a bubble content is greater than an authorised maximum content when said warning counter (13) exceeds a predefined value C known as the alarm value.

5. Process according to claim 3 characterised in that it further comprises a step consisting of sending to the client system (8) information indicating that a bubble content is greater than an authorised maximum content when said warning counter (13) exceeds a predefined value C' known as the alarm value over a period greater than a predefined time delay period.

6. Process according to any of claims 4 or 5 characterised in that it further comprises a ceasing step of sending to the client system (8) information indicating that the bubble content is greater than the authorised maximum content when the warning counter (13) is less than a predefined value D known as the final alarm value.

7. Process according to claim 1, characterised in that it further comprises a calculation step of an average value from a plurality of variations between two successive measurements of light intensity.

8. Process according to claim 7 characterised in that it further comprises a step of sending to the client system (8) information indicating the average value of the successive variations of the light intensity perceived by the light detector (2).

9. Process according to any of the above claims, characterised in that the data controlling and processing unit (6) comprising a control module of the light source (15) capable of polarising said light source (1) on several polarisation levels, the light source (1) is

polarised periodically by said control module (15) of the light source.

10. Process according to claim 9, characterised in that a
5 calibration of the sensor constituted by the source (1) and the light detector (2) is carried out synchronously on the periodic polarisation of the light source (1).

11. Process according to any of the above claims,
10 characterised in that the source (1) and the light detector (2) being arranged noticeably orthogonally, the acquisition step of the successive measurements of light intensity perceived by the light detector (2) makes it possible to acquire measurements of the quantity of light
15 rays emitted by the light source (1) which are reflected should the case arise in the presence of bubbles on the surface of a gas bubble in a direction noticeably orthogonal to the direction of incidence towards the light detector (2).

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12. Process according to any of claims 1 to 10,
characterised in that, the source (1) and the light detector (2) being arranged noticeably adjacently, the acquisition step of the successive measurements of light
25 intensity perceived by the light detector (2) makes it possible to acquire measurements of the quantity of light rays emitted by the light source (1) which are reflected should the case arise in the presence of bubbles on the surface of a gas bubble in a direction noticeably
30 parallel to the direction of incidence towards the light detector (2).

13. Process according to any of claims 11 or 12, characterised in that, the device likewise comprising a temperature measuring element and at least one switch linked to said temperature measuring element, the switch
5 is capable of changing state during the detection of a gas bubble.

14. Process according to claim 13, characterised in that, the data controlling and processing unit (6)
10 transmitting, via an interface module (7), to the client system (8) information on the temperature of the liquid and the presence of gas bubbles in the liquid, the interface module (7) and the client system (8) being linked only by a single wire, a high-amplitude level
15 signal proportional to the temperature of the liquid when the presence of a bubble is not detected or low level when the presence of a bubble is detected is sent to the client system (8) by the interface module (7).

20 15. Process according to any of claims 11 or 12, characterised in that, the device likewise comprising a system of electrodes capable of measuring the resistivity of the ambient conditions and since the data controlling and processing unit (6) being linked to the client
25 system (8) via an interface module (7), the client system (8) is informed, via the interface module (7), by the data controlling and processing unit (6), that the sensor constituted by the source (1) and the light detector (2) is not immersed in the liquid when the
30 system of electrodes identifies the ambient conditions as not being the liquid.

16. Process according to claim 15, characterised in that, the device likewise comprising a temperature measuring element and at least one switch linked to said temperature measuring element, the switch is capable of
5 changing state during the detection of a gas bubble and during the absence of liquid.

17. Process according to claim 16, characterised in that, the data controlling and processing unit (6)
10 transmitting, via the interface module (7), to the client system information on the temperature of the liquid, the presence of gas bubbles in the liquid and the non-immersion of the sensor in the liquid, the interface module (7) and the client system (8) being linked only by
15 a single wire, a high-amplitude level signal proportional to the temperature of the liquid when the presence of a bubble is not detected and when the sensor is immersed in the liquid or low level when the presence of a bubble is detected or when the sensor is not immersed in the liquid
20 is supplied to the client system (8) by the interface module (7).

18. Process according to any of claims 1 to 10, characterised in that, the source (1) and the light
25 detector (2) being arranged noticeably opposite each other, the step of light emission makes it possible to send out a light of specific wavelength from the light source (1) such that it is strongly (reciprocally weakly) absorbed by the liquid and slightly (reciprocally
30 strongly) absorbed by the gas constituting the bubbles.

19. Process according to any of claims 1 to 10, characterised in that, the source (1) and the light detector (2) being arranged noticeably opposite each other, the acquisition step of the successive
5 measurements of light intensity perceived by the light detector (2) makes it possible to acquire measurements of the quantity of light rays emitted by the light source (1) which are deflected towards the light detector (2) should the case arise in the presence of
10 bubbles due to the diffraction index differences between the liquid and the gas constituting the bubbles at the level of the surface of said bubbles.

20. Process according to any of claims 18 or 19,
15 characterised in that, the device likewise comprising a temperature measuring element and at least one switch linked to said temperature measuring element, the switch is capable of changing state periodically.

20 21. Process according to claim 20, characterised in that, the data controlling and processing unit (6) transmitting, via an interface module (7), to the client system information on the temperature of the liquid and the presence of bubbles in the liquid, the interface
25 module (7) and the client system (8) being linked only by a single wire, a periodic signal is supplied to the client system (8) by the interface module (7).

22. Process according to claim 21, characterised in that
30 the period of said periodic signal is formed by a first phase constituted by a constant high-amplitude level signal proportional to the temperature of the liquid and

by a second phase constituted by a train of pulses of modulated width, the width of the impulses being modulated according to the average value of the successive variations in light intensity perceived by the light detector (2).

23. Process according to any of claims 18 or 19, characterised in that the client system (8) is informed, via an interface module (7), that the sensor is not immersed in liquid when the polarisation value of the light source (1) is lower than a predefined threshold value T, known as the polarisation alarm threshold value.

24. Process according to claim 23, characterised in that, the device likewise comprising a temperature measuring element and at least one switch linked to said temperature measuring element, the switch is capable of changing state periodically.

25. Process according to claim 24, characterised in that the data controlling and processing unit (6) transmitting, via the interface module (7), to the client system the information on the temperature of the liquid, the presence of bubbles in the liquid and the non-immersion of the sensor in the liquid, the interface module (7) and the client system (8) being linked only by a single wire, a periodic signal is supplied to the client system (8) by the interface module (7).

26. Process according to claim 25, characterised in that the period of said periodic signal is formed from a first phase constituted by a constant high-amplitude level

signal proportional to the temperature of the liquid and a second phase constituted by a train of pulses of modulated width, the width of the impulses being modulated according to the average value of the successive variations in light intensity perceived by the light detector (2) and said width being maximum when the sensor is not immersed in the liquid.

27. Device of detection of gas bubbles in a liquid comprising light emission means, light detection means and data controlling and processing means linked to the light detection means, characterised in that following emission of light by the light emission means and following the detection of light by the light detection means, the data controlling and processing means are capable of obtaining light detection means of the successive measurements of light intensity detected by the light detection means and of calculating a variation in light intensity between two successive measurements of light intensity.